



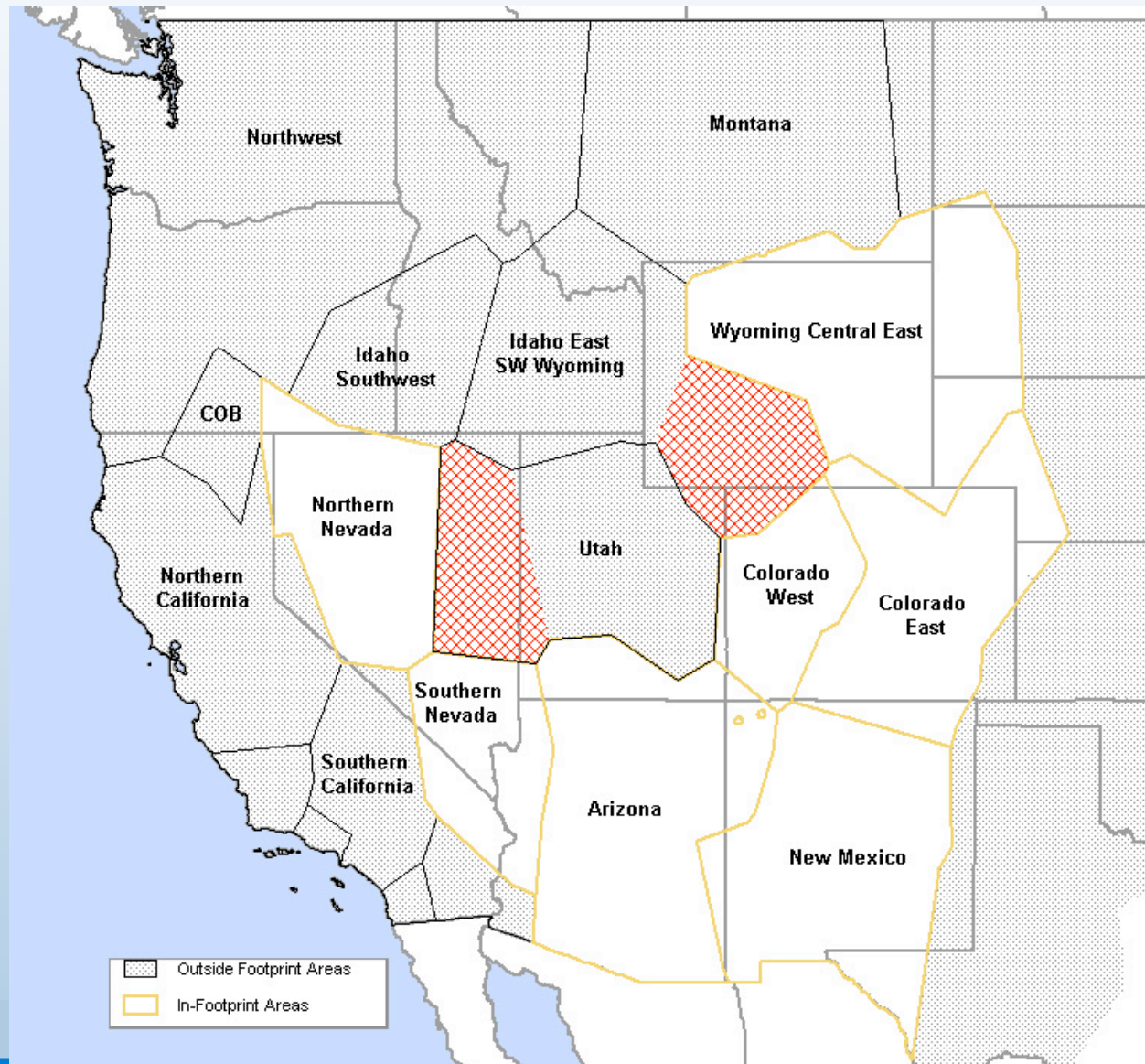
# Western Wind and Solar Integration Study Update

**Debbie Lew**  
**NREL**  
**TRC Conference Call**  
**12-8-08**

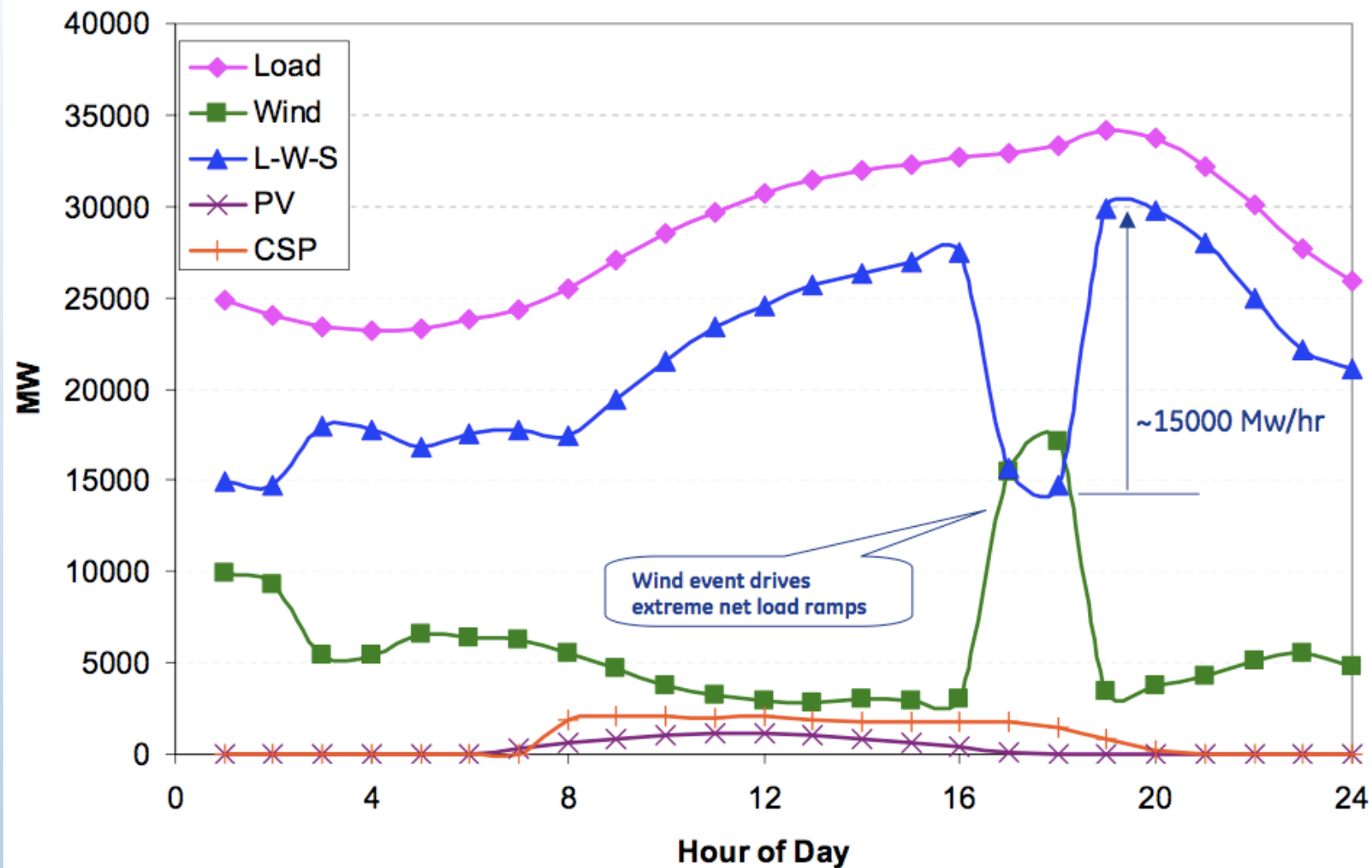
# Outcomes from Stakeholder Meeting

- Reviewed preliminary analysis, identified issues, finalized initial scenarios
- Revised study footprint
- Wind data/site selection glitch
- Solar PV issues
- Finalized initial scenarios
- Revised schedule/workplan

# Revised study footprint



# Oct 8, 2006 (being revised)



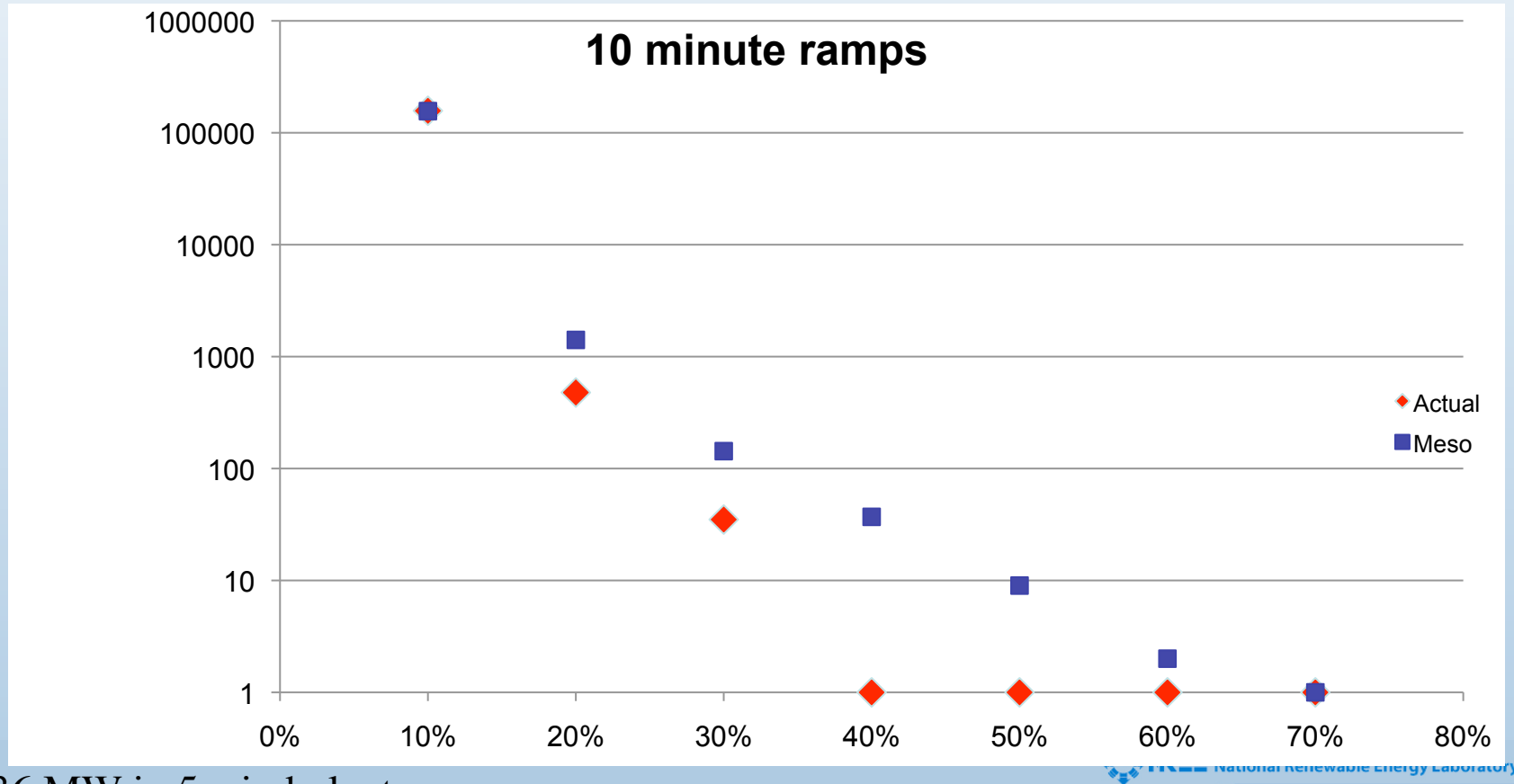


# Wind Data

- Analysis at Stakeholder meeting exhibited extreme wind blips in data.
- 3TIER found post-processing glitches and re-ran mesoscale model for 1/3 of the data.
- New dataset in Oct
  - <http://www.nrel.gov/wind/westernwind>
- Extensive validation

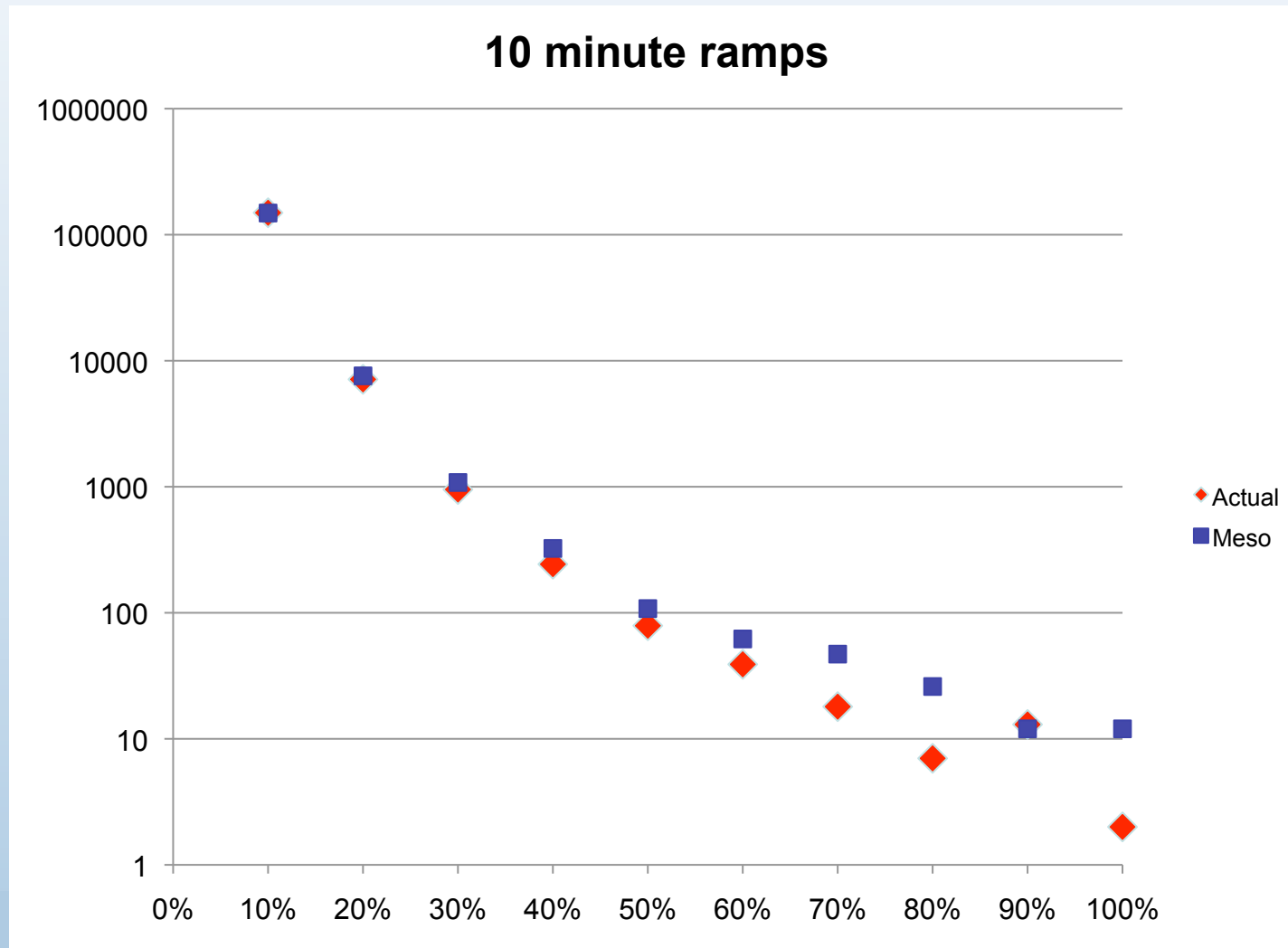
# Texas wind data validation

| Capacity Factor | 2004  | 2005  | 2006  |
|-----------------|-------|-------|-------|
| Actual          | 31.2% | 33.0% | 34.1% |
| Mesoscale       | 34.6% | 32.1% | 33.8% |



# Another site wind validation

Mesoscale wind data capacity factor is off by 2-9%

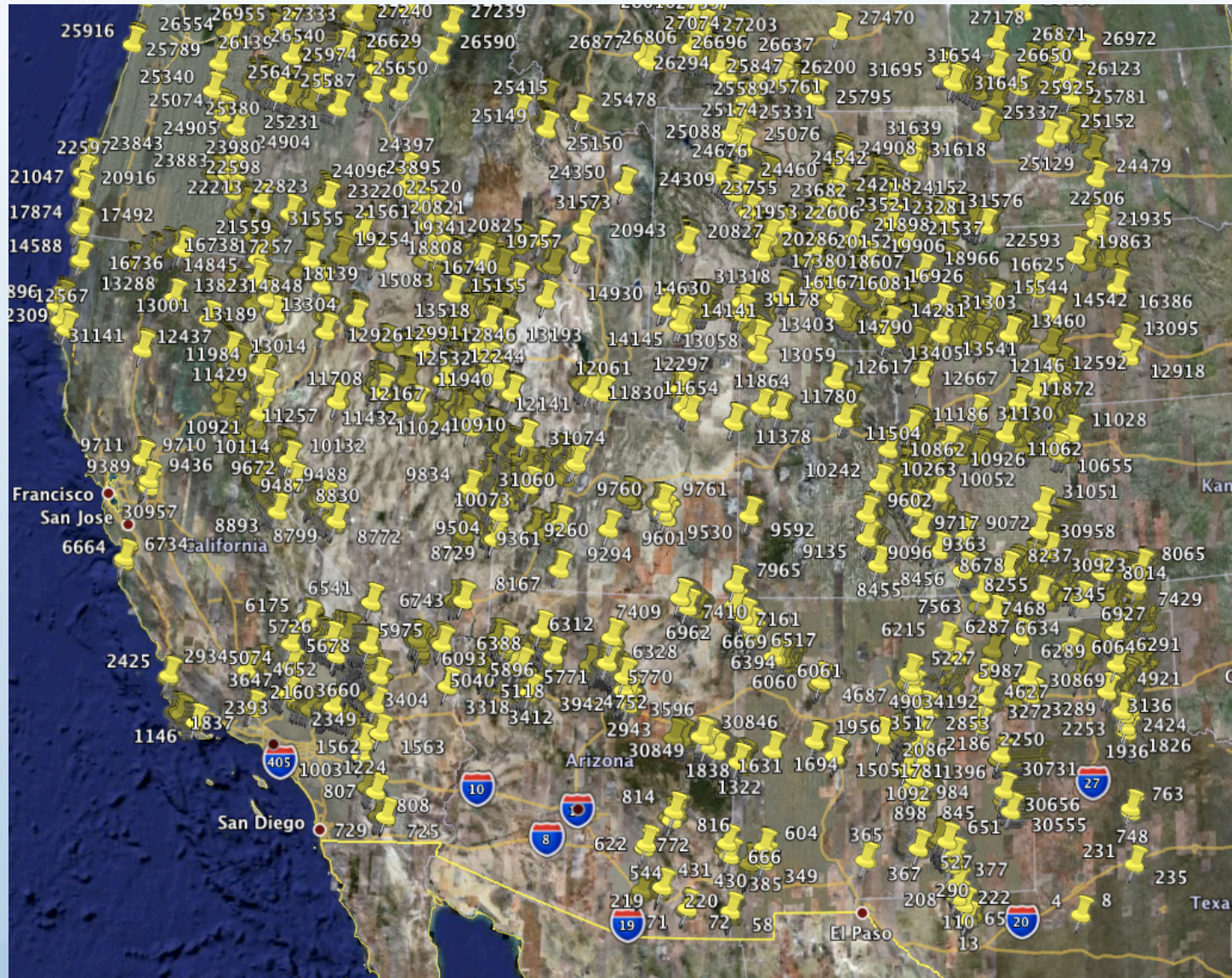


# Site Selection for Scenarios

- 35% in-area (30% wind/5% solar)
- Focus of study is operational impacts. This is not a renewable energy zone or transmission planning study.
  - Siting is not intended to be exactly right. We care about the power profiles more than the exact locations. Our siting is automated.
  - Western Renewable Energy Zone results could be folded in as sensitivity analysis or follow-on analysis.
- Underwent another round of site exclusions
  - Didn't take all existing exclusions into account. 35% in-area isn't a realistic scenario, but a starting point for analysis. If we were really trying to get 35% in-area renewables, however, existing exclusions would have to be relaxed.



# Excluded additional sites

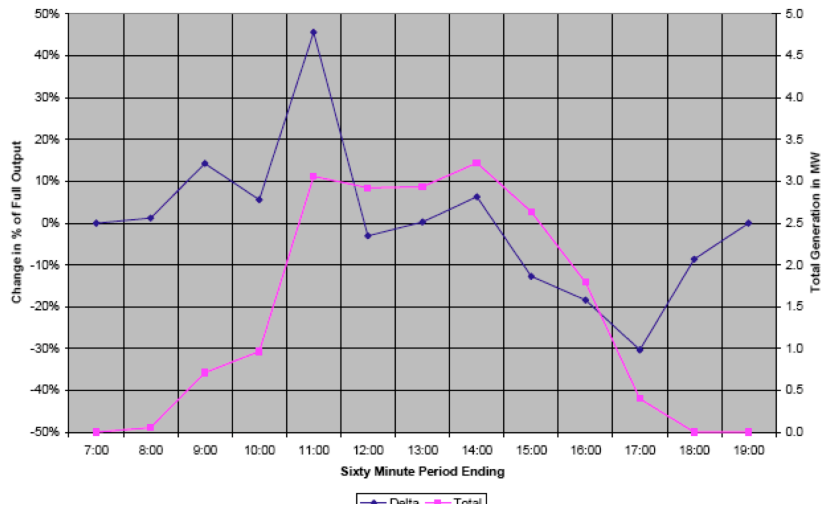


# Solar PV Data

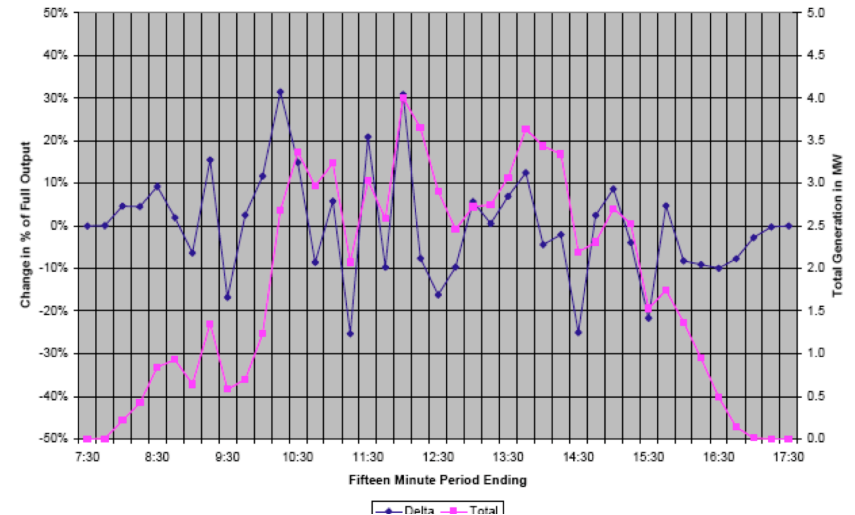
- In certain conditions (partly cloudy, windy), PV plant output can exhibit large fluctuations over short time scales (up to 50% in 10 sec)
- NREL developing methodology for generating 10 minute PV data from gridded hourly radiation combined with specific 1-10 minute PV plant measurements
- Key is to get ramp statistics correct
- Not an issue for CSP

# Need for Subhourly PV Analysis

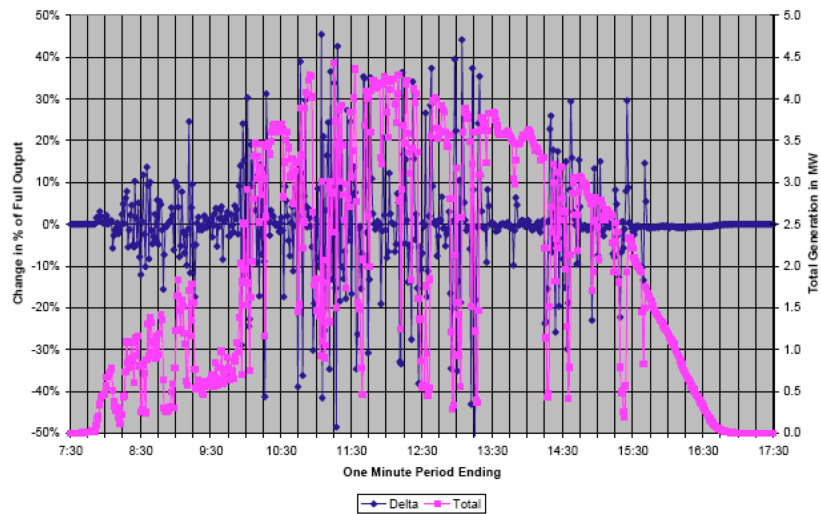
SGSSS 12/3/2005 60 Minute Power Changes for the Full System



SGSSS 12/3/2005 15 Minute Power Changes for the Full System



SGSSS 12/3/2006 1 Minute Power Changes for the Full System



SGSSS 12/3/2005 10 Second Power Changes for the Full System

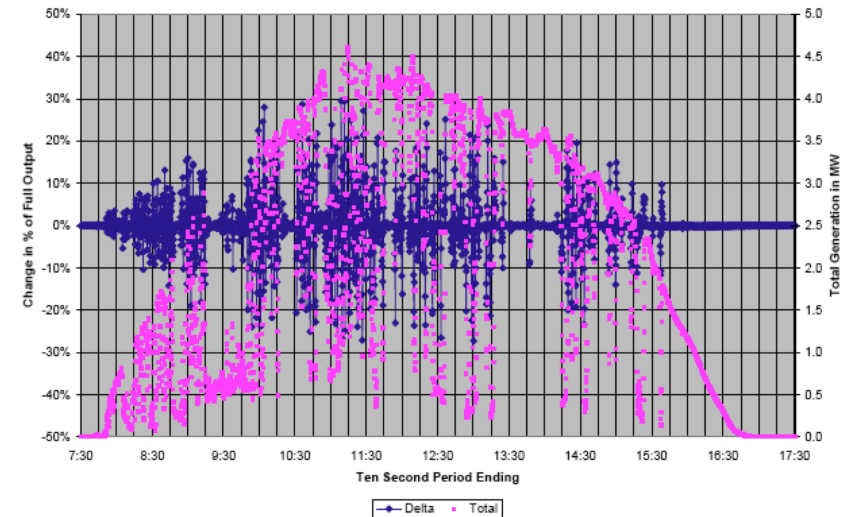


Figure 10

Figure 11

Source: Tom Hansen, Tucson Electric Power

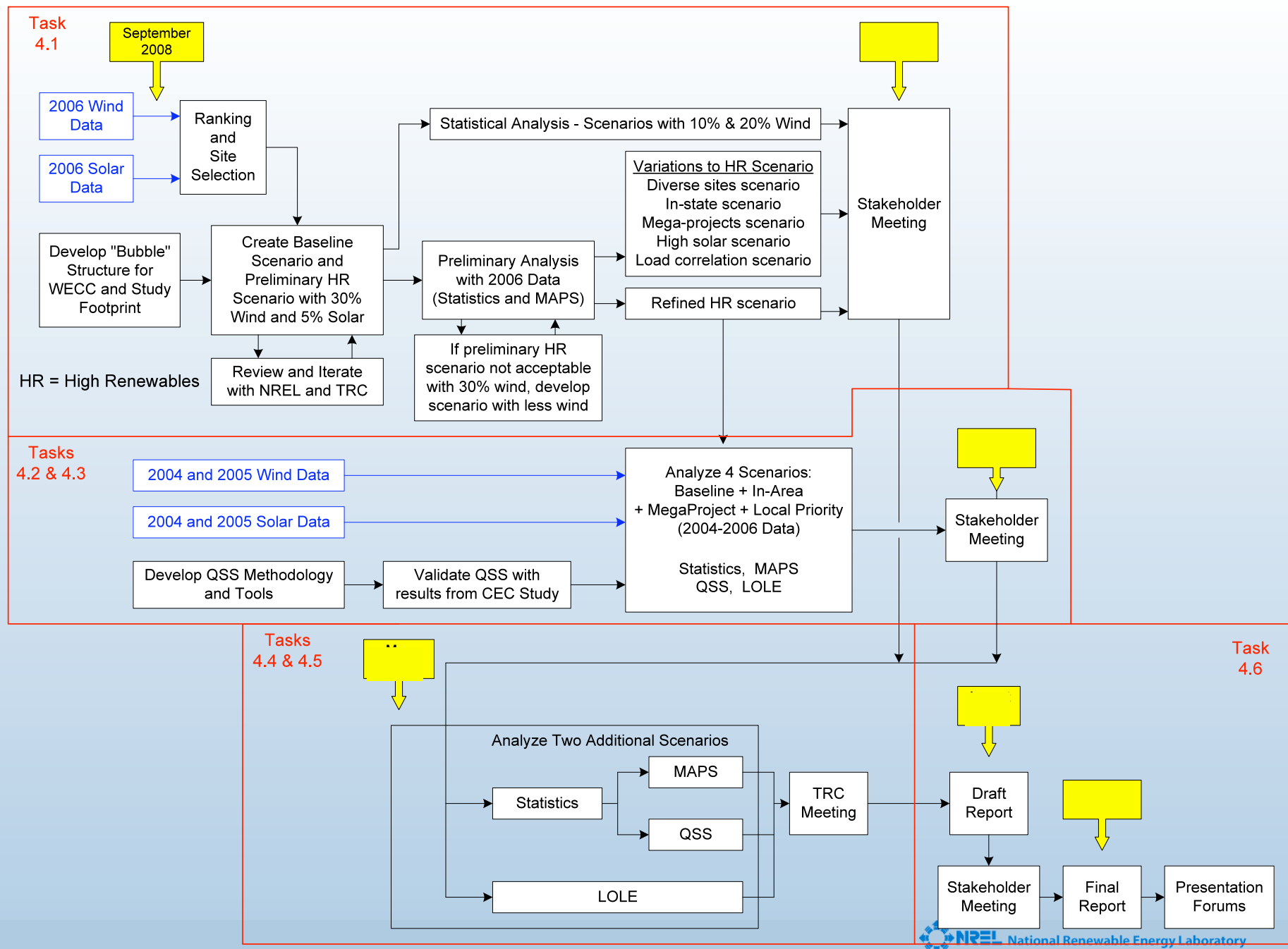


# Scenarios

- “In-area”
  - Each transmission area meets 35% of its load from wind and solar sites in that area
- “Mega projects”
  - Each transmission area meets 35% of its load from wind and solar sites that have the least cost of delivered energy
- “Local priority”
  - Similar to Mega projects but with small bonus given to in-area sites
- “High solar”
  - Similar to Mega projects or Local priority but with ~10% solar penetration
- “High capacity value”
  - Each transmission area meets 35% of its load from wind and solar sites that are best correlated with load -have highest capacity value
- “High geographic diversity”
  - Each transmission area meets 35% of its load from wind and solar sites that are geographically diverse

# Tasks and Schedule

- Stakeholder Meeting (5/23/07)
- Data Collection (second half '07)
  - Wind and solar mesoscale modeling (3TIER, SUNY, NREL)
  - Utility load, generator, transmission data (Exeter)
- Preliminary Analysis (first half '08) - GE
  - Extensive statistical analysis with various options for wind/solar sites and transmission
- Scenario Development (8/08) - GE
  - In-state vs out-of-state resources
  - Geographically diverse resources
  - Mega projects
  - Best correlated with load
- Stakeholder Meeting (8/14/08)
- Revise statistical analysis and scenarios with new wind data
- Run Scenarios (1<sup>st</sup> half 2009) - GE
  - Examine costs due to regulation, load following, unit commitment
  - “Dives” to investigate issues such as Hoover
  - Examine mitigation strategies/options
  - Determine contributions to reliability and capacity value
- Stakeholder Meeting – Preliminary Results (spring '09)
- Stakeholder Meeting and Final Report (fall '09)





# Information

- WWSIS
  - Website at
  - [http://westconnect.com/init\\_wwis.php](http://westconnect.com/init_wwis.php)
  - Western wind dataset at
  - <http://www.nrel.gov/wind/westernwind/>
  - Solar dataset to be posted soon to
  - <http://mercator.nrel.gov/wwsi/>
- Contact
  - Debbie Lew
  - [debra\\_lew@nrel.gov](mailto:debra_lew@nrel.gov)
  - 303-384-7037